DRAFT

EVALUATION OF PROBABLE BENEFITS AND COSTS

AND

LEAST BURDENSOME ANALYSIS

For Proposed (2003 Negotiated Draft)

Shoreline Master Program Guidelines

June 12, 2003

EXECUTIVE SUMMARY

Washington Department of Ecology (Ecology) must make a determination on whether the probable benefits exceed the probable costs associated with the new proposed Shoreline Master Program Guidelines rule. It must also make a determination whether the new proposed rule changes are the least burdensome alternative.

This analysis provides information to assist Ecology in its determination of whether probable benefits would exceed probable costs associated with new proposed rule changes. It also provides information to assist Ecology in the determination of whether the new proposed rule changes are the least burdensome alternative.

The benefits considered are the public's valuation of shoreline improvements and the benefit from land appreciation due to vegetation conservation, setbacks, clearing and grading, etc. The costs considered are the foregone land value, loss of employment and government implementation costs. Other benefits and costs, if not impossible, are very difficult to be quantified based on existing knowledge and data. Qualitative analyses are utilized to analyze these unquantifiable benefits and costs. We conclude that they are unlikely to be large compared to the quantified costs and benefits.

The result of this cost benefit analysis suggests that the probable benefits exceed the probable costs.

This analysis also suggests that the proposed shoreline master program guidelines rule is the least burdensome option that will achieve the general goals. Two other alternatives were looked at for this analysis.

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Evaluation of Probable Benefits and Costs and Least Burdensome Analysis

For

The 2003 Draft of
The Negotiated Shoreline Master Program Guidelines Rule

May, 2003

The Department of Ecology (Ecology) is considering updating the Shoreline Master Program Guidelines rule. RCW 34.05.328 mandates that:

"(1) before adopting a rule…., an agency shall….(c) determine that the probable benefits of the rule are greater than its probable costs taking into account both the qualitative and quantitative benefits and costs and the specific directives of the statute being implemented; (d) determine, after considering alternative versions of the rule and the analysis required under…(c) of this subsection, that the rule being adopted is the least burdensome alternative for those required to comply with it that will achieve the general goals and specific objectives stated under (a) of this subsection."

This analysis describes the probable benefits and costs for the proposed Shoreline Management Guidelines. It supplements and should be read in conjunction with the Small Business Economic Impact Statement (SBEIS) prepared for this proposed rule adoption.

Ecology has determined that the probable benefits of the proposed rule exceed the probable costs and that this rule is the least burdensome alternative for those required to comply.

1. Background and Significant Changes

Ecology is proposing changes to the Shoreline Master Program Guidelines rule. The Shoreline Management Act (SMA, RCW 90.58) charges Ecology with periodically reviewing and amending guidelines for implementing the SMA (RCW 90.58.060).

Ecology's objective in adopting the proposed rule amendment is to:

1. Comply with the legislative mandate at RCW 90.58.060
2. Update the existing rule to bring it into conformance with current knowledge and practices.

Recognition that the existing rule has not adequately protected shoreline environments produced this rule revision. The Environmental Impact Statement (SEA, 2003) described the current state of shorelines:

Riparian habitats have been altered or degraded. Wetland loss continues, apparently at undiminished rates. Estuarine water quality is variable, and in places sub-standard. Overall more commercial shellfish beds are being downgraded than are being upgraded due to ongoing pollution problems. As more and more people build larger and larger houses on and near unstable slopes the problems associated with land sliding become greater. Nearly two miles of Puget Sound shorelines are armored each year, adversely affecting beach and near shore habitats and the creatures that depend on those habitats for all or a portion of their life cycle.

The purpose of the 2003 draft of the proposed guidelines is "to assist local governments in developing master programs". Therefore the requirements are addressed to local governments, not private entities. It affects approximately 250 local governments statewide, including all 39 counties and the balance of municipalities fronting on shorelines of the state. Local governments must comply with a number of provisions and will be required to either prepare or simply update their existing Shoreline Management Programs (SMP) consistent with the new guidelines. Deadlines for completion of local updates statewide will start in 2005 and end in 2014.

To comply with the new requirements of the guidelines, local governments must inventory existing shorelines to identify ecological functions, estimate future demand for shorelines, consider public access, establish activity policies and regulations, establish environment designations, prepare new development standards, and submit a revised SMP. They must also consider ecological restoration, vegetation conservation, geologically hazardous areas, flood hazards and management of critical saltwater habitats.

2. Overview of Benefits and Costs

The proposed rule changes will result in improvements to the environment, but will also impose costs on those required to comply. Ecology must determine if the probable benefits exceed the probable costs associated with the proposed new rules.

Uncertainty limits this analysis. It is impossible to know with certainty how a particular local government will revise their SMP. Therefore, this analysis presents an estimate of the environmental benefits and costs based on available data, and hypothetical "scenarios". Since it is impossible to know with certainty how a particular local government will revise its SMP. Moreover, even if the effects could be predicted, the lack of any available data on the linkage between the requirements in the guidelines and environmental improvements produces uncertainty regarding the magnitude of the benefits associated with the proposed rule.

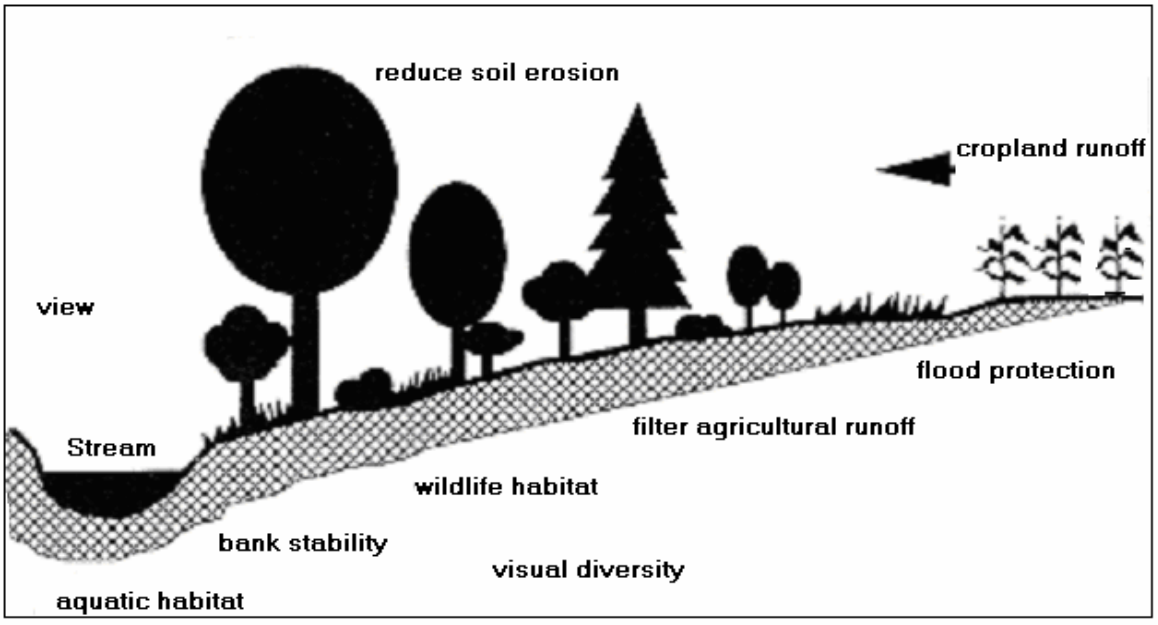
2.1 Overview of Benefits

The general master program provisions include requirements for flood hazard reduction, public access, shoreline vegetation conservation, water quality, storm water, non-point pollution, etc. Various social benefits will be generated from these provisions including the following:

Improvements to aquatic habitat
Shoreline areas are an essential component of aquatic habitat. Bare, un-shaded, sediment-laden channels provide poor habitat for fish and other aquatic organisms. Shoreline vegetation will provide shade that reduces light intensity and water temperature, which is particularly important for cold water fisheries; provide plant litter as well as insects and other invertebrates on plants which are food for fish; provide larger plant debris and roots, which form stable shelter for aquatic organisms.

Improvements to upland wildlife habitat
It has been shown that expansive cultivated cropland provide insufficient cover and food for upland game, songbirds, and other wildlife, especially in winter. Perennial vegetation supplies wildlife with a diversity of cover and food options, which are very good for smaller animals and birds. Connected buffer stretches become wildlife corridors, greatly improving habitat for larger animals.

Graph 1. Benefits that a riparian buffer can provide[1]



[1] Agroforestry Notes. USDA Forest Service.

Improvements to water quality
An important function of a buffer system is to reduce water pollution. Above ground, the dense stems of native prairie grasses, shrubs, and trees physically slow surface runoff from fields and out-of-bank floodwater, which causes sediment to be dropped on the soil rather than in the waterway. Sediment from adjacent fields, which ends up in the buffer strip, prevents phosphorus and pesticides from entering the stream. Below ground, roots improve soil porosity which allows more surface runoff to soak into the soil. Native trees, shrubs, and prairie grasses develop significantly deeper and greater root masses than crop plants and cool-season grasses.

Improvements to recreational amenities
Shoreline areas are natural magnets for recreational activities. Tourists are drawn to the areas for clean water, fisheries, wildlife and historical and cultural resources. Shoreline areas in urban centers could be especially important places where residents can escape from the activities in the city and engage in recreational activities. Shoreline vegetation conservation and public access relate positively to recreation and tourism by improving water quality and by improving the aesthetics of shoreline corridors.

Reduced flood damage
Flooding has caused the deaths of more than 10,000 people since 1900 and property damage from flooding now totals over $1 billion each year in the United States[1]. The flood hazard reduction provision in the new guidelines provides both structural and nonstructural measures to reduce flood damage and will effectively reduce it.

Increase property value
Various studies have found that a protected shoreline corridor provides various amenities that can increase property values in the nearby community.

Aesthetic and Cultural Benefits
Expansive cultivated cropland and armored shorelines may have less visual diversity than would be desired. Strips of trees, shrubs, and perennial grasses add visual diversity to shoreline areas; evergreens and deciduous trees, shrubs provide color diversity at certain times of the year.

Filter nutrients, pesticides and microbes
High contaminant levels degrade drinking water quality and aquatic habitat. Specifically, nitrate and pesticides can be toxic to humans and aquatic organisms; fecal bacteria and other microbes in animal wastes can cause disease; and phosphate can promote algae blooms which suffocate fish and other aquatic organisms. The shoreline vegetation is effective at trapping phosphorus, transforming nitrate, ammonia and organic nitrogen into harmless gas, therefore allowing permanent removal of high concentrations of these

[1] SEA: Floods emergency information.

nutrients. Other contaminants, including metals, pesticides, and biological pathogens, can also be trapped by buffers and in some cases transformed into less harmful forms.

Stabilize banks and reduce soil erosion
Eroding and collapsing banks can remove valuable agricultural land, and cause landslides, which pose a safety risk and reduce property values. Soil from bank erosion settles in the waterway, which damages aquatic habitat; degrades drinking water quality; and fills wetlands, lakes, and reservoirs. Vegetation will stabilize shoreline banks and reduce soil erosion since plant stems will absorb the erosive force of flowing water and wave action, and roots will assist in holding soil in place.

Navigation
Sediment collected in harbors and navigational waters reduces the water's capacity to handle commercial ships and often leads to dredging in order to keep the channels open. Besides the expenses, dredging can create water quality problems by generating turbidity and stirring up heavy metals and other contaminants from the bottom. Turbid waters have been linked to shipping accidents and delays, and can cause damage to a ship's engines and propellers. Under the new guidelines, sediment levels will be reduced and therefore should result in lower navigation costs.

Benefit from Federal Programs[1]
Some federal programs aggressively promote the use of buffer strips in cropped fields, along field edges, and along waterways. Many of these practices are eligible for special treatment and payments under the Conservation Reserve Program (CRP) and other conservation programs. Practices like contour strips, filter strips, windbreaks, grass waterways and other uses of buffers can pay big conservation dividends on a minimal commitment of land. These federal programs provide net benefits to Washington residents.

The benefits estimated (see Table 1) are the public's valuation of shoreline protection and improvements, which will result in improved habitat for fish, improved habitat for wildlife, improved water quality, reduced flooding and recreational benefits. In addition, this CBA considers benefits associated with property (land) value appreciation. Other benefits, however, are very difficult (if not impossible) to estimate based on existing information and knowledge and were not quantified.

[1] Stewardship Incentive Program (SIP) - State Department of Agriculture-Forestry Services; Environmental Quality Incentives Program (EQIP) – USDA; Partners For Wildlife (PFW) – USFWS; Wildlife Habitat Incentives Program (WHIP) – USDA; Conservation Reserve Program - (CRP).

Table 1 Potential Benefits

Potential Benefit:	**Measures and Effects:**
Improved Habitat for Fish	NPV* in dollars From 1996 Survey
Improved Habitat for Wildlife	NPV in dollars From 1996 Survey
Improved Water Quality	NPV in dollars From 1996 Survey
Recreational Benefits	NPV in dollars From 1996 Survey
Reduced Flooding	NPV in dollars From 1996 Survey
Property Value Increases	Estimated (In Combined Model)
Aesthetic and Cultural Benefits	Not estimated, will increase benefit
Filter Nutrients, Pesticides and Microbes	Not estimated, will increase benefit
Reduced Soil Erosion	Not estimated, will increase benefit
Stream Bank Stabilization	Not estimated, will increase benefit
Navigation	Not estimated, will increase benefit
Federal Programs - Financial Assistance	Not estimated, will increase benefit

**NPV: Net Present Value*

2.2 Overview of costs

The 2003 draft of the negotiated shorelines guidelines rule will improve significantly the shoreline environment, however, inevitably there will be additional costs.

- The dominant costs will be the value of foregone land use resulting from constrains on new developments and/or redevelopments.
- Some industries may experience employment losses.
- The requirement for mitigation is stricter, but it may or may not increase the total costs[1].
- Restoration will mostly depend on the availability of grants, volunteer programs or other tools.
- Government implementation cost consists of initial implementation of the proposed rule amendments and for ongoing administration.
- Other costs may include additional costs for permits, the cost for the loss of site choices, etc.

The costs estimated are basically the loss of some use value of land due to vegetation conservation, setbacks, clearing and grading standards, etc. Other costs (Table 2) estimated are employment losses and government implementation costs. As is the case for benefits, other costs prove to be difficult to be quantified before local governments revise their SMP and more data are available.

[1] If the inventory of shorelines is conducted properly, and the resulting shoreline regulations are designed to protect existing functions, then new development, where allowed would actually require less mitigation for impacts. This is because new development would be directed away from sensitive areas that would be greatly impacted by such new development. If development that has significant impacts is allowed, the development would be conditioned in the permit process to mitigate for such impacts.

Table 2 Potential Costs

Potential Costs:	**Measures and Effects:**
Constraint to Land development:	
Agricultural Development	Estimated, will increase cost
Forest	Estimated (Under FPR[1]), will reduce benefit.
Residential, Commercial and IndustrialDevelopments	Estimated (In Combined Model)
Other development	Not estimated, will increase cost
Employment loss	Estimated, will increase cost
Restoration and Mitigation Cost	Not estimated, will increase cost
Government Implementation Costs	Estimated, will increase cost
Other Costs	Not estimated, will increase cost

3. Time Horizon and Discount Rate

Long run forecasts are difficult to do. Most forecasts are based on historical data which do not consider changes in preference, economic structure and technology. This analysis is also subject to these limits. Most of the 'future data' used is linearly derived from historical data. Moreover, some of the historical data is incomplete. On the other hand, to reveal the whole effects of a new rule, a long run analysis is better than a short run analysis. So in this cost benefit analysis, a 15-year horizon is utilized to balance these two aspects. The initial period was assumed to be 2004/2005, and the end of the 15-year period was assumed to be 2019/2020.

The discount rate reflects the time value of money. Benefits and costs are worth more if they are experienced sooner. All future benefits and costs, including non-monetized benefits and costs, should be discounted. The higher the discount rate, the lower is the present value of future cash flows. The discount rate used in this analysis is 2.9%. Other values, low (2.0%) and high (3.8%) are also used to test the sensitivity.

4. Benefits

Measurement of the benefits associated with a policy change is easier if the resource in question is a marketed commodity and information on prices and quantities consumed are available. This information can be used to define a demand curve and can be used to quantify the benefits.

Unfortunately, most of the benefits generated from the new shoreline guidelines are from "commodities" that are not associated with a market, and no market prices exist. Moreover,

[1] FPR: Forest Practices Rules.

we don't know the quantity of these beneficial "commodities" produced by the new proposed rule amendment, because the existing science can not clarify the cause and effect relationship between them. Although it is impossible to assess these benefits directly, alternative methods have been developed in economics to analyze broad policy shifts that may have a wide range of beneficial impacts.

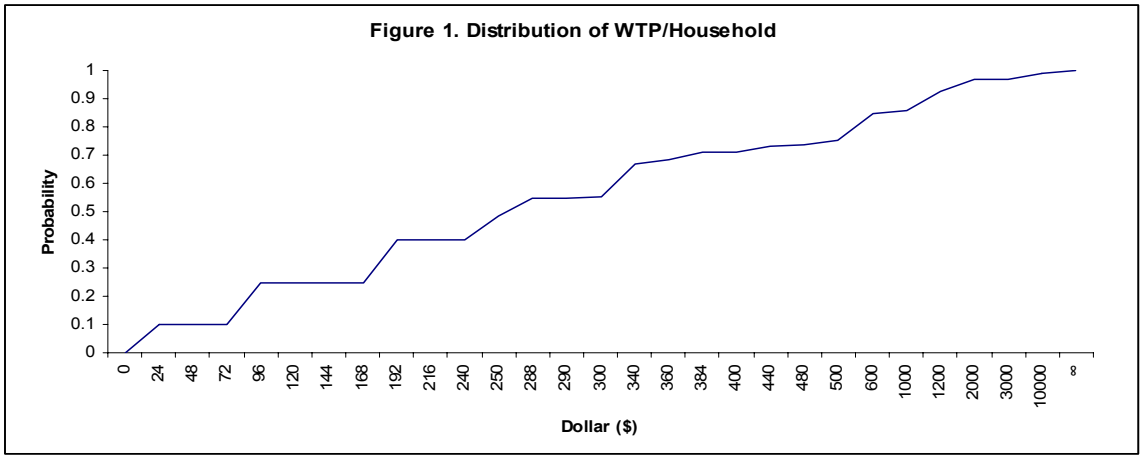
One of the most frequently used methods is the contingent valuation (CV) method which utilizes survey techniques to indirectly derive people's willingness to pay for the "commodities" and therefore derive the benefits. Even so, not all benefits are assessed in this analysis due to the lack of knowledge and data. The quantitative benefits consist of two parts. The first part is derived from a survey conducted by the social and economic science research center of Washington State University for Ecology in 1996, which includes the benefits from improved habitat for fish, improved habitat for wildlife, improved water quality, reduced flooding and recreational benefits[1].

Corroborating evidence for the value of simultaneous shifts in amenities related to property regulations can be derived from hedonic analysis of property prices. In so far as a land owner can obtain the amenity created by a set of rules it will be reflected in the value of the property. People most commonly think of this in terms of a price premium for a school district or a view. In this case, setbacks generate amenities that affect adjacent property values. This part of benefits from property value increases will be calculated in a combined cost benefit model in the costs section.

Contingent valuation surveys generate data based on hypothetical scenarios. Given this the survey data has been handled conservatively, in that assumptions were chosen that would be biased against the proposed rule. The 1996 survey suggests that, generally, people thought that the shoreline is over-developed. When asked about their preferred shoreline uses, people tended to have high priorities for wildlife habitat, public parks and fishing. Conversely, they register low or no priority for marinas, industry, shops or restaurants, office buildings, apartments and condominiums. Questions that assisted in determining the value residents place on shoreline management were also asked. From the answers to those questions the distribution of willingness to pay (WTP) of each Washington household for shoreline improvements in 1996 can be derived. Figure 1 below is the distribution (cumulative distribution function, CDF)

[1] Question 121 to Question 137 in 1996 survey. 'Reduced litter' is included in the total benefits, but we assume it is not significantly large.

Figure 1



The mean and median of WTP for each Washington State household in 1996 were calculated based on the distribution. The mean is $373.19 per household per year and the median is $248.47 per household per year. Only the median is used in the benefits analysis[1].

It is reasonable to assume that people want to pay a fixed portion of their income instead of a fixed amount of money for environment protection. However, this analysis only assumes the households just want to pay a fixed amount of money and this conservative arrangement will result in significantly reduced benefits (about 50%). To calculate the total social benefit, the total number of households needs to be determined by using data on population and household size. The population trend[2] and the household size trend[3] were decided by the data obtained from OFM[4]. Because the household size is relatively stable, 2.468 persons/household[5] was chosen as the average household size. After calculating the households in Washington State each year from 2005 to 2020, the willingness to pay[6] for shoreline improvement each year from 2005 to 2020 can be calculated. Discounting them to year 2002/2003, and multiplying by the adjustment coefficient (Appendix A), yielded the results shown in Table 3.

[1] The Mean is sensitive to outlying values. The median was deemed to be a more appropriate measure.
[2] Washington State Office of Financial Management. FORECAST OF THE STATE POPULATION BY AGE AND SEX: 1990 TO 2030 NOVEMBER 2002 FORECAST.
[3] Washington State Office of Financial Management. Illustrative Household and Persons per Household Projections.
[4] Office of Financial Management, Washington State.
[5] Forecasting data in year 2010.
[6] With income growth

Table 3. Adjusted Total Benefit under different buffer and discount rate (million dollar)

Discount Rate	2.00%	2.90%	3.80%
Buffer 50	5,434.7	5,293.3	5,156.8
Buffer 100	8,190.1	7,977.1	7,771.4
Buffer 150	9,878.1	9,621.2	9,373.1

For the economic analysis, the width of the buffer is important because it determines the total benefits. However it is impossible to know what the buffer will be before the local governments adopt their own master programs. Therefore three possible buffer widths, 50 feet, 100 feet and 150 feet are assumed in this analysis. From Table 3, the total benefit from the proposed shoreline guidelines is approximately 5-10 billion dollars in the 15-year period. The analysis is not too sensitive to the discount rates. For example, when the discount rate is 3.8%, maintaining a 150 feet buffer will result in $9.37 billion benefit while a 2.0% discount rate results in $9.88 billion. This is a smaller percentage change than that of the discount rate.

5. Costs

The proposed guidelines rule applies to new developments or redevelopments, and does not apply retroactively to existing uses and structures. Therefore the first step in the analysis is to determine how much land is likely to be developed. However, information is limited and some assumptions have to be made based on the best knowledge and best available data.

The most significant cost of the new guidelines is the cost from the constraint to land development by setback or buffer requirements[1]. To the landowners, the constraint means additional limitations may be placed on the use of their land, and economically means the loss of some of their land value. As is in the benefit analysis, the width of buffer is important because it determines the loss of land value. The same possible buffer widths, 50 feet, 100 feet and 150 feet are assumed in the cost analysis.

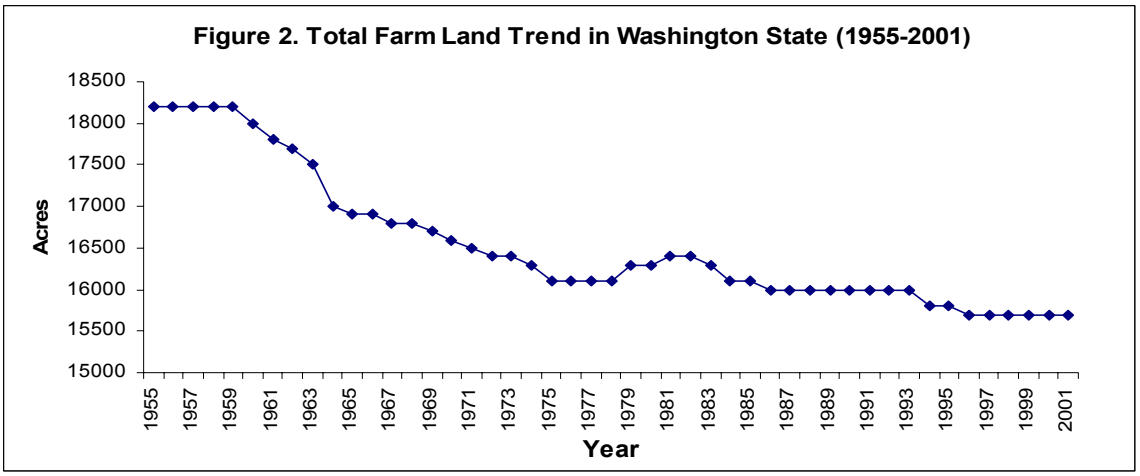
Different sectors face different gain and loss situations. For residential properties gains in value due to the compliance of adjacent land owners may offset losses in value for limitations on the use of the property itself. For agriculture adjacent land owner compliance may have little impact on property values.

5.1. Agriculture costs

The new guidelines rule requires new agricultural development to maintain a buffer along the shorelines for shoreline vegetation conservation, which means (most if not all)

[1] The new guidelines require establishing vegetation conservation standards, and the methods to do this include setback or buffer requirements, clearing and grading standards, regulatory incentives, environment designation standards, or other master program provisions.

agricultural activities are not allowed in the buffer. If the buffer requirement did not exist, farmers could plant or graze in the land to be used as a buffer and generate a cash flow. Due to the buffer, no cash flow will be generated and it can be treated as a loss (cost) to the farmer. The factors that determine the cost are the acreage of buffer in the shoreline that will be developed for agricultural use in the 15-year period and the price of land[1].



From Figure 2[2], the decline of land for agricultural uses in Washington is obvious. More elaborately, figure 3[3], which is drawn from USDA census data for 20 years from 1978 to 1997, also clearly shows the declining trend. Contrary to the declining trend on the state level, some counties do show the opposite. County level data (USDA, 1997) show that 33 out of 39 counties in Washington experienced agricultural land decline from 1978 to 1997, with range from -1.52% to -58.22%. At the same time, six counties show increases in agriculture land (Table 4). To be conservative, the percentage increase in farm land for the 15-year period was assumed to be the same as the 20 year period from 1978 to 1997. Further the analysis assumes a 1% increase of new agricultural development in counties with farm land net loss less than 5% from 1978 to 1997[4].

[1] County level data are used, because the difference of land prices is very big among counties. Land appreciation is not considered in all models which will result in total less benefit. Other production inputs are not loss to the agriculture because they are saved, which can join other production process (except labor under high unemployment). Corp value is the result of inputs, it is on the other side of the production function, no reason to treat it as agriculture loss.

[2] Data Source: USDA agricultural statistics database.

[3] Data Source: U.S. census Bureau.

[4] Including Chelan, Lincoln and Yakima County. The reason for county level analysis is due to different land prices. The reason for all these arrangements is that only net increase or decrease of farmland data are available, but the data needed are the new development.

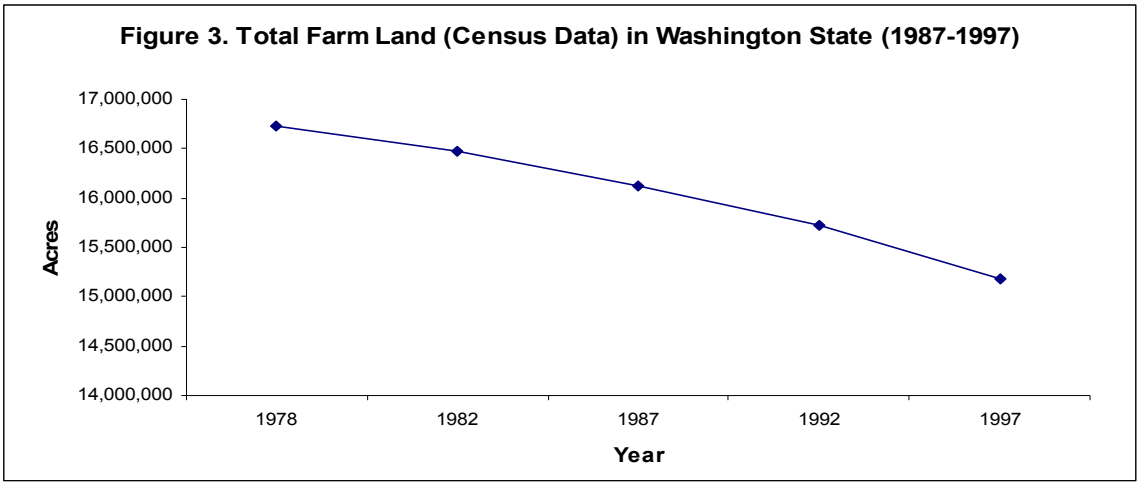


Table 4. Counties with agricultural land increase (1978-1997)*

County Name	Farm Land Increase (Acres)	Farm Land Increase (Percentage)
Asotin	14540	5.02
Ferry	81000	1.91
Kitsap**	10965	136.47
Mason**	9603	92.36
Pacific	2221	5.88
San Juan	495	3.00

** The same data source as Figure 3.*
*** Data for Kitsap county and Mason county seem abnormal, but no other reliable data sources are available. However, it tends to be conservative by overestimating the cost.*

The method used to estimate the costs is shown in Appendix B. It is possible that the new agricultural development may occur in other counties even if they have previously experienced a net total decline[1]. However, no data are available to estimate how much new development takes place. This analysis assumes it is not more than the total of the nine counties.

Given the data and the assumptions, the value of the land lost under a 150 feet buffer will be 6.9 million dollars (Table 5). The employment or wage loss (measured in dollars) associated with land loss (appendix B) is about 1.9 million under a 150 feet buffer. So the total would be approximately $8.8 million[2] over 15 years.

[1] Agricultural land is developed for other uses and at the same time other land is developed for agricultural use. Net loss doesn't mean no new developments. Although there is uncertainty here, it will not affect the final result because its absolute value is too small.
[2] It is less than 0.01% of final agriculture sector output (Washington Agriculture Statistics, 2001).

The costs for agricultural development are probably overestimated, because:

1. The estimated wage loss is a maximum or ceiling of this kind of loss. Wage losses depend on the condition of the job market. If the unemployment rate is low, farm workers can find other jobs, and the wage losses will be very short term and thus lower than these estimates.

2. Some federal programs provide financial assistance to environmental conservation. These funds provided by these programs are benefits (not estimated) to Washington State, and would significantly reduce the net costs for agricultural development.

Table 5. Total estimated costs for agriculture (million dollars)

	50 Feet Buffer	100 Feet Buffer	150 Feet Buffer
Land Value loss	2.3	4.6	6.9
Wage Loss	0.6	1.3	1.9
Total Agriculture loss	2.9	5.9	8.8

5.2 Forest Costs

The proposed guidelines rule maintains that "local master programs should rely on the Forest Practices Act and rules implementing the act and the Forest and Fish Report as adequate management of commercial forest uses within shoreline jurisdiction." There will be very little, if any, costs for the forest industry due to the new shoreline guidelines rule, and any benefits of maintaining a buffer in the commercial forest areas will be attributed to the Forest Practice Act. Because the benefits estimated based on the 1996 survey include all benefits from improving the shoreline environment and this includes forested areas, the potential benefits of the proposed guidelines alone, without forest practices, is only a part of estimated total benefits. Thus the benefits of the proposed guidelines should be the estimated total benefits based on the CV minus the benefits of other regulations. There is no way to do this so the costs of the forest practices rule must be counted toward the costs of this proposed rule.

The cost benefit analysis for the forest practices rules implementing the forest and fish report was done by Perez-Garcia (2000). From Perez-Garcia's research[1], the foregone timber asset value is 2.678 billion dollars, and the wage loss[2] is from 2.387 to 3.420 billion dollars. The existing forest practices affected all forest practices, while only new developments will be affected under the new shoreline guidelines. The forest costs were calculated in a 20-year time horizon, adjusting these costs to the 15-year period, they will be:

[1] Table 10 in Perez-Garcia (2000).

[2] As in agriculture, the wage loss may or may not happen depending on the condition of the job market. This wage loss number gives a ceiling to that kind of loss.

Table 6. Forest costs (million dollars)

	Low	High	Average
Foregone timber asset value	2,008.5	2,008.5	2,008.5
Lost Wages	1,790.3	2,565.0	2,177.6
Total	3,798.8	4,573.5	4,186.1

**These numbers are under proximately 140 feet buffer on average.*

Thus these costs must be subtracted from the total benefits in order to have a comparable value.

5.3 Residential, Commercial and Industrial (RCI) developments[1]

In public opinion, residential, commercial and industrial uses are not preferred uses in shoreline areas. More and more people believe that shoreline areas have been overdeveloped for these uses. The principle costs associated with residential, commercial and industrial developments is similar to that described for agricultural development. The main cost to landowners is a loss in land value. However the landowners only lose a portion of their land value, not all. Although there are restrictions to the development on the buffer, it still generates some amenities to the affected landowners themselves and/or landowners nearby[2]. Different landowners and different economic sectors have different opinions about the loss. This makes it difficult to arrive at an estimate of the net impact.

In the analysis of agricultural development, the assumption is that the buffer will not affect the agricultural yield out of the buffer[3]. But to residential, commercial and industrial (RCI) developments, maintaining a buffer will cause the price of land behind the buffer (up to 4000 feet from the waterfront[4]) to appreciate. Thus, although waterfront parcels lose development flexibility which is a cost, surrounding parcels benefit through increased green spaces, view corridors, etc.

[1] This analysis focuses on land and do not care about the properties on it. It is likely that competition will level the price differences between different uses. Water-dependent, water-related and water-enjoyment new commercial and industrial development will not be significantly affected under the new shoreline guidelines. Usually, commercial is mixed with residential, the spillover of residential benefit will affect commercial; industrial development is not a priority in planning, in most cases, new industrial development is away from the shoreline areas, it contribute to the total new development areas but not to the total in the shoreline areas.

[2] Only when the landowner relinquishes all the property right of buffer land, should it be thought that they lose all the buffer value.

[3] In fact, the reduction of erosion will increase agricultural yield, at least in the long run.

[4] Research is listed in appendix C. Some facts: housing prices were 32% higher if they were located next to a greenbelt buffer in Colorado. Nationally, buffers were thought to have a positive or neutral impact on adjacent property values in 32 of 39 communities surveyed. Likewise, California homes near stream restoration projects had a 3 to 13% higher property value than similar homes along un-restored streams. (Schueler and Holland)

Figure 4. RCI Land Price Change Model

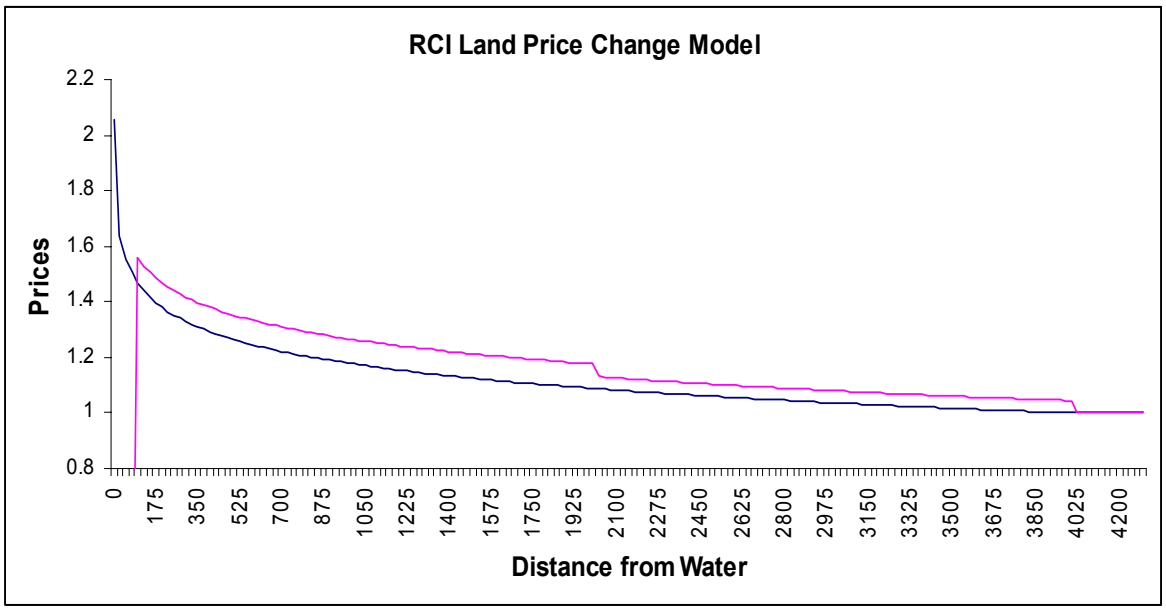


Figure 4 illustrates the model[1] to be used in analyzing the new RCI developments. The land[2] is most expensive at the waterfront, and decreases at an increasing rate until 4000 feet from the waterfront, where no land value premium exists. The land within 150 feet from the water has a significantly larger premium, because the houses above it are the first 1-2 rows along the water and have the best views, the best access to water and other amenities from water. There is much less land value premiums for houses behind them, because the views are blocked, the access is limited, etc. The farther from the water, the fewer amenities to the property owner and the less of the land value premium.

If there is a buffer, land outside the buffer will appreciate[3]. The reasons may be better views, better access to the water, open space and other amenities. The buffer premium would also decrease with the distance, and land 2000 feet away from the water only has half of the initial buffer premium while no buffer premium exists 4000 feet away. On the other hand, the land value within the buffer will decrease due to limitations to the land uses. So in the new residential, commercial and industrial developments, the benefits are combined with the costs. The benefit is the social economic gain from the land appreciation and the cost is the land value loss.

The above model provides an illustration of the RCI model. Moreover, to calculate the total benefits and costs, we need two other variables: the land price and the total new

[1] Appendix C.
[2] The property value includes land value and the structure (improvement) value. Assume the correlation of structure value and the distance to water is zero.
[3] Appendix C.

developments. The land prices use county level data divided into rural and city areas. The reason for this division is that the differences in land prices for rural and city land are huge, about 1 million in Seattle and less than ten thousand in rural areas per acre. The total new RCI developments use the same principle as the agricultural development. The model used to calculate benefits and costs is further described in Appendix C. The results from the analysis are listed in Table 7.

Table 7. Net Benefit from new RCI development (million dollar)

	50 feet buffer	100 feet buffer	150 feet buffer
City	347.2	286.1	193.4
Rural	14.0	8.4	1.7
Total	361.2	294.5	195.1

5.4. Local Government SMP Update Costs[1]

The best information available on SMP update costs is the results from an analysis conducted by Ecology staff and a small number of local governments[2] in 1999. The study attempted to elicit actual costs of updating individual local government shoreline master programs, not including the day-to-day cost of implementing such programs. After extrapolating to 250 local governments likely to be affected by the proposed rule amendments, the total cost was determined to be approximately $18.8 million.

5.5 Costs to other industries

More or less, other industries will be affected by the new guidelines.

- Aquaculture: Aquaculture is considered a preferred use of water areas and the expected improvements in water quality will benefit aquaculture. Although there are additional requirements related to eelgrass and micro-algae, as well as the spread of disease and non-native species, aquaculture should benefit from the new guidelines in the long run.

- Boating facilities: As noted in the environmental impact analysis, no substantial difference in activities is expected in the long term for these facilities, which means no additional net costs or benefits.

- Mining: Mining may experience stricter requirement under the new guidelines, because "Mining in shoreline generally alters the natural character, resources, and ecological functions of the shoreline". However, "in some circumstances, mining may be designed to have benefits for shoreline resources", and "if properly sited, designed, conducted, and completed" (SEA, 2003), it will cause no net loss of ecological functions of the shoreline. Mining is already heavily regulated industry with many state and federal requirements already apply. This makes the analysis of

[1] Bafus, 2002
[2] City: Buckley, Bellingham, Dayton, and Everett. County: Pend Oreille, Walla Walla and Yakima.

the impacts on the mining industry difficult. After the specific requirements are determined by the local government, then analysis could be done on a case by case basis.

- Recreational development: The new guidelines require that shoreline recreational development be given priority and non-water-dependent recreational uses be restricted or set back from the shoreline. This should not result in significant costs or benefit in the long run.

- Transportation and parking: The guidelines state that "Where other options are available and feasible, new roads or road expansions should not be built within shoreline jurisdiction." However, any such facilities necessary to serve a primary authorized shoreline use are allowed by the new guidelines. Even if there are some costs, they should not be very large.

- Utilities: "[Utilities] shall not be allowed in shoreline areas unless it can be demonstrated that no other feasible option is available." But when necessary, utilities can be located in shoreline areas. The costs to utilities are likely to be small.

Other potential impacts include:

Preferred Uses: Water Dependent, Water Related, Water-enjoyment are preferred uses. These uses will receive special preferential treatment under the proposed guidelines. This preference is given because without it the use or business would not be viable at all. These uses will be allowed to build structures that are not preferred for other uses, such as docks, marinas. The total costs for industries that generate these uses are expected to be smaller than for uses that do not require water contact or viewing.

Bulkhead: The new guidelines discourage new bulkhead and also it seems unnecessary to protect properties by bulkhead if a buffer is maintained. Clearly some construction companies will lose business, but on the other hand, property owners will save money for alternative uses, which is a benefit. The overall effect will not be large.

Other uses: If the industry does not provide one of the uses above it will not receive preferential treatment. Selecting another location will not have as significant an impact on the businesses.

6. Transfers and Distribution Effects

Under the new guidelines, wealth transfer may happen among levels of government, individuals and businesses. For example, although the vegetation conservation requirement will benefit the whole community, the landowner may experience some loss if all his land is in buffer, however, the options for obtaining variance and other administrative remedies should significantly reduce such costs, which is a wealth transfer from government to the

landowners. At the same time, some benefits transfer to inland and surrounding property owners as a result of land appreciation. "The equity of the distribution of benefits and costs, are, of course, real and important – especially to those who experience them. Societies can, and do, address these by other means involving both public and private actions and programs." (Bafus, 2002). However, this problem is beyond the scope of this cost benefit analysis.

7. Conclusion

As noted before, this cost benefit analysis is based on the best available information; the scenarios and hypothetical constructs used to illustrate potential benefits and costs are intended to be reasonable[1]; the models are intended to reflect the best existing research. However, it is impossible to define the impact exactly in any given situation that may arise. Moreover, because shoreline areas are one of the most heavily regulated areas, many of these benefits or costs are the direct result of other laws, rules and programs, and it is difficult to distinguish between their impacts and those impacts that are a result of the proposed shoreline guidelines. But, the probable benefits are far greater than probable the costs, any small adjustments of the model, parameters and/or data should not alter the final results.

The conclusions below are a logical derivation of above analysis:

1. The new guidelines will result in potentially significant social benefits through better shoreline protection and improvements.

2. Along with the benefits, the new guidelines will potentially impose additional costs on new developments and re-developments in shoreline jurisdiction.

3. Compared with the benefits, the costs are relatively small, and the implementation of the new guidelines should generate net benefits in billions of dollars (see Table 8) in a 15-year time horizon.

4. A existing buffer (as a result of other regulations) will significantly reduce both benefits and costs of the guidelines, however, it will not result in negative net benefits (see Table 9).

Table 8. Total Potential net Benefits for various buffer widths (million dollar)

Benefit Or Cost	50 Feet Buffer	100 Feet Buffer	150 Feet Buffer
WTP (Survey)	5293.3	7977.1	9621.2
Total forest	-1495.0	-2990.1	-4485.1
Total R.C.I	361.1	294.5	195.1
Total Agriculture loss	-2.9	-5.9	-8.8

[1] Conservative assumptions (reflecting higher costs/lower benefits) were used whenever required.

Government implementation costs	-18.8	-18.8	-18.8
Net Benefit	4137.7	5256.8	5303.5

Table 9. Total Potential net Benefits under various existing buffer widths (million dollar)

	50 Feet Buffer (SMA)	100 Feet Buffer (SMA)	150 Feet Buffer (SMA)
existing 50 Feet buffer (CAO,etc)	0*	1119.1	1165.8
existing 100 Feet buffer (CAO,etc)	0	0	46.7
existing 150 Feet buffer (CAO,etc)	0	0	0
existing 200 Feet buffer (CAO,etc)	0	0	0

* It is not necessary to be zero, depending on the stringency of other regulations.

8. Least Burdensome Alternative Analysis

The Washington Administrative Act (APA) requires that significant legislative rules be evaluated to "[d]etermine, after considering alternative versions of the rule and the analysis required under (b) and (c) of this subsection, that the rule being adopted is the least burdensome alternative for those required to comply with it that will achieve the general goals and specific objectives stated under (a) of this subsection." (RCW 34.05.328(1)(d)).

This determination must be documented prior to final rule adoption and included in the rulemaking record. This analysis summarizes whether this version of guidelines is the least burdensome alternative that will achieve the general goals and specific objectives of the statute.

Three significant alternatives of the new shoreline guidelines rule considered during the rule-making process are chosen in this analysis. These alternatives are described below.

Alternative A – Prescriptive Standards
The Prescriptive Standards approach requires a rule with specific numerical standards, and effective state-wide. It sets minimum requirements for local governments to achieve through their local SMP for all shoreline uses. With highly specific direction to local governments and a strict test for compliance, these criteria allow for less flexibility and creativity. Since Washington's shoreline environments are extremely diverse, it is impossible to set standards to fit all circumstances. To achieve the general goal of the proposed rule, the prescriptive standards tend to be more stringent in order to fit the worst cases. Obviously the stricter the rule, the greater the compliance costs. So this alternative is more costly for both the local government and the private sector than the performance standards, which are flexible.

Alternative B – Dual Path Performance standards
The Dual Path Performance standards consist of two distinct parts: Path A and Path B. Path A sets forth mandatory minimum procedures and performance based standards, but allows local governments the flexibility to decide how to achieve the performance standards. Path B provides specific means to satisfy Endangered Species Act (ESA) requirements. Use of Path B by local governments is voluntary. Alternative B was proposed in 2000 by Ecology and was viewed as too burdensome by Washington Association of Business and Washington Aggregates and Concrete Association. In 2003, Ecology negotiated Alternative C in response to the burden concerns.

Alternative C – Negotiated Settlement Performance Standards
This alternative is the 2003 draft of the negotiated shorelines guidelines rule and it is a derivative of Alternative B. Comparing with Alternative B, Alternative C allow more flexibility to local governments. Some of the distinctions of Alternative C are:

- More explicit acknowledgement that there are legal limitations on the regulatory authority of state and local government with respect to private property.
- In general, greater reliance is placed on general standard on no net loss, less on prescriptive standards.
- Not attempting to specifically address compliance with the Endangered Species Act.

All these distinctions make Negotiated Settlement Performance Standards less restrictive, and result in less compliance costs and less burdensome than the Dual Path Performance standards.

Comparing the three alternatives, Alternative A is not flexible and will result in stricter standards than Alternative B and Alternative C. Alternative B is more restrictive than Alternative C in term of flexibility for the local governments. Since stricter standards will result higher compliance costs and higher burden to those to comply, Alternative C, the 2003 draft of the negotiated shorelines guidelines rule, is the least burdensome alternative of the three alternatives.

Appendix A. Benefit (WTP) from 1996 Survey[1]

The Contingent Valuation Method (CV) uses survey questions to elicit people's preferences for public goods by finding out what they would be willing to pay for specified improvements. The method is thus aimed at eliciting their willingness to pay (WTP) in dollars. It circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the goods in question. If the study is well designed and carefully pre-tested, the respondents' answers to the valuation questions should represent valid WTP responses, and a benefit estimate can be derived.

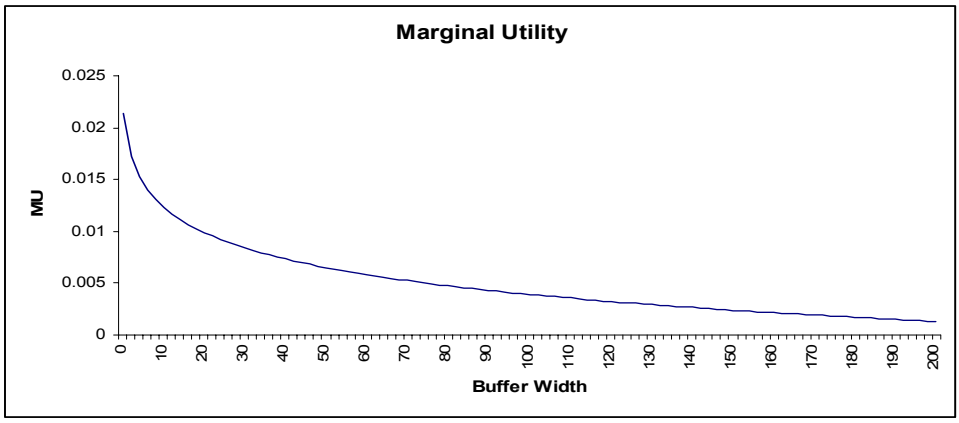
The contingent valuation method is employed in this study to derive the benefits from Improved Habitat for Fish, Improved Habitat for Wildlife, Improved Water Quality, Recreational Benefits and Reduced Flooding. The distribution of WTP of each household in Washington can be derived from the survey. It is relatively simple to calculate the mean and median of the WTP from the distribution. Then the quantity of households in Washington each year is determined and this is multiplied by the median WTP. It is then discounted, and the result is the total benefit from CV.

The problem with the survey utilized for this study is that it didn't ask how much people were willing to pay for different quantities of "shoreline goods". It is reasonable to assume the wider the vegetation conservation area, the more effective the shoreline protection and the more people would want to pay for it, so the benefit was adjusted to different buffer widths.

[1] Survey of Washington Households on the Shoreline Management Act and Related Shoreline Issues. July 1996. Washington State Department of Ecology.

Assuming the aggregate marginal utility function is:

$$MU = C - a\log(x+1) \qquad x: \text{width of buffer}$$



From the graph above, the decreasing of marginal utility is obvious, which means people want to pay more for the first one foot buffer than the additional one foot buffer[1].

The total utility function will be:

$$U = Cx - a[\, x\log(x+1) - x + \log(x+1)]$$

Assume that when x=50, people want to pay half of their total WTP, because they are not fully satisfied with the shoreline improvements, and when x=200, people want to pay all[2]. The result is C=0.02141, a=0.0037897.

Table A1. The adjustment coefficient:

Buffer width (foot)	50	100	150
Coefficient	0.5000	0.7535	0.9088

The coefficient means that if 50 feet of buffer is required, half of the benefit from CV will be attained by the society; a 100 feet buffer increases it to 75.35% and 150 feet buffer to 90.88%.

[1] Vegetation conservation is the dominant factor to decide the total benefit and cost, and buffer width can serve as an indicator of shoreline improvement.

[2] The WTP will extend to a long run if not infinite, so in the15 year period people should pay full even if the shoreline improvements are limited.

Appendix B. Agricultural Development

Under the vegetation conservation requirement, it is difficult for farmers to develop agricultural land in the shoreline buffer zone. It is a loss, or cost, to the farmer because this buffer land could generate a cash flow if no buffer requirement exists.

Land loss:
Assume the ratio of existing agricultural land in the shoreline (S) to the total existing agricultural land (T) will remain constant over time, then

$$\Delta S/\Delta T = S/T, \quad S = LW$$

Δ means new development; L is new developed shoreline length and W is shoreline width (a constant).

$$\Delta L = L\,(\Delta T/T)$$

$\Delta T/T$ can be derived by historical data[1]; and L by GIS[2] data.

Let B be the buffer width, and P be the price[3] of agricultural land.

$$\text{The total loss} = PB\Delta L$$

Wage loss:
Assume the number of farmers[4] in Washington State is n, the wage/year[5] is w, the income grows at i per year and the discount rate is d. The total wage loss in a certain year will be:

$$(Wageloss)_n = B\Delta Lnw(1+i)^n/[T(1+d)^n];\ \ n=\text{year}-2002$$

$$\text{Total wage loss} = \sum_{n=3}^{18}(Wageloss)_n$$

[1] Only when $\Delta T/T>0$ are there new shoreline development. There are nine counties in Washington State.
[2] GIS data is subject to disclaimer.
[3] Although in many cases the area adjacent to water is considered marginal land because of erosion or drought-prone soils, steep or rolling slopes, poor drainage, and low soil fertility. However, in some cases this area is influenced by the flood plain and can be highly productive. Therefore, we assume a consistent yield and use the USDA data. Data source: Agri Land Price USDA 1997 Census of Agriculture Volume 1: Part 47, Chapter 2, Washington County-Level Data. Table 6 Farms, Land in Farms, Value of Land and Buildings, and Land Use: 1997 and 1992.
[4] Washington year book 2000. 1999 data Including Agriculture, forestry and fishing. Will overestimate the cost.
[5] 2001 Washington State Employment and Wage Estimates. Employment Security.

Appendix C. Residential, commercial and industrial development

An economic model based on existing research to analyze how the new guidelines will affect residential, commercial and industrial developments (RCI) is developed in this section.

The Model:
From assessor's database, no obvious trend that the commercial land price is greater than that of residential (or the opposite). To determine this land price, data from major King County cities were used.[1] It is unnecessary to divide the land according to its final use[2] in the model.

Because there are extra amenities living close to water, a land value premium (P_r) needs to be paid for it. The maximum land value premium (P_{rmax}) will be paid to land with a waterfront[3], and the premium will extend at least 4000 feet from the waterfront[4]. Suppose P_{4000} is the land price per square foot 4000 feet from the water, and P is the land price per square foot at a point less than 4000 feet from the water, then:

$$P = P_{4000} + P_r \quad \text{……………………………………………(1)}$$

Let d be the distance from the waterfront, and α' is a coefficient,

$$P_r = P_{rmax} - \alpha' \log(1+d) \quad \text{…………………………………(2)}$$

The choice of log form[5] is based on existing research[6].

If a buffer is required, although the landowner will loose the full use of the buffer, maintaining a buffer will increase inland land or property values by an additional buffer premium[7]. The wider is the buffer (B), the more is the buffer premium, but at a decreasing rate. If a buffer with width B is required, it results in a buffer premium P_B:

$$P_B = \theta\beta' \log(1+B) \quad \text{…………………………………….(3)}$$

θ is a parameter[8] used to adjust P_B.

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[1] Seattle, Bellevue, Redmond, Kent, Kirkland. Data from King County assessor's database.
[2] There is no housing structure appreciation due to close to water.
[3] Lansford and Jones, Wenger and Fowler, Brown and Pollakowski, Orr, et al., Colby and Wishart, Dornbusch and Barrager.
[4] Dornbusch and Barrager, Brown and Pollakowski, Lansford and Jones, Colby and Wishart.
[5] 1+d instead of d, because log1=0.
[6] Brown and Pollakowski, Orr, et al., Mahan, et al., Colby and Wishart, Bin and Polasky, Irwin.
[7] Wenger and Fowler, Brown and Pollakowski, Orr, et al., Colby and Wishart, Dornbusch and Barrager.
[8] When $d<2000$, $\theta = 1$; $2000 < d < 4000$, $\theta = 0.5$; $d > 4000$, $\theta = 0$.

From (1), (2) and (3):

$$P = P_{4000} + P_{rmax} - \alpha' \log(1+d) + \theta\beta' \log(1+B) \quad \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Divide both sides by P_{4000}:

$$p = 1 + p_{rmax} - \alpha \log(1+d) + \theta\beta \log(1+B) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots..(5)$$

$$p = P/P_{4000},\ p_{rmax} = P_{rmax}/P_{4000},\ \alpha = \alpha'/P_{4000},\ \beta = \beta'/P_{4000}$$

When d = 4000 and B = 0,

$$\alpha = p_{rmax}/\log(4001) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(6)$$

Suppose $\gamma = \beta/\alpha$ is a constant,

$$\beta = \alpha\gamma = \gamma\, p_{rmax}/\log(4001) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

Then, it is easy to derive the total benefit from land appreciation, it is:

$$b = (4000\theta - B)\gamma\, p_{rmax}\, P_{4000} \log(1+B)/\log(4001) \quad \ldots\ldots\ldots\ldots\ldots\ldots(8)$$

while the cost from land loss will be:

$$c = \eta \int_0^B P_{4000}[1 + p_{rmax} - p_{rmax}\log(1+r)/\log(4001)]\, dr$$

$$= \eta\, P_{4000}\{(1 + p_{rmax})B - p_{rmax}[B\log(1+B) - B + \log(1+B)]/\log(4001)\} \quad \ldots\ldots\ldots(10)$$

η is a parameter[1] to describe the percentage of land loss due to buffer.

The benefit and cost above is the benefit and cost for ONE FOOT of buffer[2]. To know the total benefit and cost from new residential, commercial and industrial developments, it is necessary to know how many feet of shoreline will be developed in the 15-year period.

Suppose the ratio of existing RCI in shoreline (S) to RCI total (T) will remain constant into the future, then as in agricultural development

$$\Delta S/\Delta T = S/T, \quad S = LW$$

Δ means new development; L is new developed shoreline length and W is shoreline width (a constant).

[1] $0 < \eta < 100\%$. It means landowner will lose a portion of the buffer land value, not all.
[2] The benefit extends 4000 feet from the water as in the model.

$$\Delta L = \Delta T \, (L/T) \quad \text{.....(11)}$$

$$\Delta T = \Delta R + \Delta C + \Delta I \quad \text{.....(12)}$$

The simple model[1] below suggests that residential development is decided by population growth (ΔPOP)[2], persons per household (HH)[3], housing density (DU)[4].

$$\Delta R = \Delta POP/(HH \times DU) \quad \text{.....(13)}$$

For commercial development, a ratio of 12.4 acres of commercially developed land per 1000 population (Van Horn, 1989) is utilized, and

$$\Delta C = 12.4 \times \Delta POP/1000 \quad \text{.....(14)}$$

However, this research is based on a survey of land patterns in medium-sized cities, for counties dominated by big cities[5],

$$\Delta C = \mu \, \Delta R \quad \text{.....(15)}$$

And $\mu = 0.6$ from King county data[6].

The industrial development is just like (15)

$$\Delta I = \tau \, \Delta C \quad \text{.....(16)}$$

$\tau = 0.4$ in the model[7].

In (11), T and L can be gathered from GIS data, then

$$\text{Total benefit (RCI)} = b\Delta L \quad \text{.....(17)}$$
$$\text{Total cost (RCI)} = c\Delta L \quad \text{.....(18)}$$

[1] Although more complex model may result in some differences, it will not alter the final result because it can't alter the signs.
[2] Data Source: PROJECTIONS OF THE TOTAL RESIDENT POPULATION FOR THE GROWTH MANAGEMENT ACT HIGH SERIES: 2000 T0 2025 (Released January 2002). OFM
[3] Data Source: OFM, Household projections, 2002.
[4] Some data are from buildable land report. For the others, density is 4.0 DU/acre for cities and 0.2 DU/acre for rural and unincorporated.
[5] Benton County, Clark County, Franklin County, King County, Pierce County, Snohomish County, Spokane County, Thurston County, Whatcom County, Yakima County.
[6] Seattle: $\mu = 0.7028$; Bellevue-Redmond-Kirkland: $\mu = 0.6366$; Other Cities: $\mu = 0.6036$.
[7] From Buildable Land Report, τ is about 1 in King county, 0.5 in Clark county and about 0.3 in Thurston county. Although $\tau = 0.4$ is subjective, but the final result is not sensitive to the choice of τ.

The Data and Parameters:

The data used in the model are county level data, because state level data are too crude for the model. For example, we can not say the land price in Seattle is in the same range of that in Yakima. On the other hand, it is obvious that if smaller jurisdiction data are used, it would be more accurate, but it is impractical. Even with county level data, not all data are available.

P_{4000} can be derived from the assessor's database or from sampling[1]. p_{rmax} needs more information, but only data from King County and Thurston County are available, so the results from King County and Thurston County are applied to other counties with some adjustments. γ is based on Brown and Pollakowski's research, whose two results are 0.6949 (Green Lake) and 0.2307 (total). In this analysis, γ is adjusted downward, with incorporated cities equals to 0.14 and unincorporated and rural area[2] equal to 0.04 (results in less benefit). Three buffer widths are chosen for B, 50 feet, 100 feet and 150 feet. The choice of η is subjective, because no related information is available and the assumption is η = 75% (75% loss of land value in buffer) in incorporated cities and η = 35% in other area. Table C1 below is the sensitivity analysis of η. When the landowner's loss increases from 65% to 85% (30.8% increase), the net benefits decrease from $324 million to $247 million (-23.9% decrease). The elasticity is less than 1, and the net benefits are not too sensitive to the choice of η.

Table C1. Sensitivity analysis of η (million dollar)

η	65%	75%	85%
City	$324.9	$286.1	$247.2

It must be pointed out that in this analysis, not only county level data is used, but also each county is subdivided into incorporated cities and un-incorporated and rural regions, especially for King County, the cities are divided into three group[3] so as to choose appropriate parameters.

[1] From www.realtor.com. For cities which the sample size is not enough, an estimated value is used.

 Shoreline and buffer open land are not so scarce in rural area.

[3] Group 1: Seattle Mercer Island; Group 2: Bellevue, Redmond and Kirkland; Group 3, Other cities.

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